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A New and Reliable Method of Securing Skin Grafts to the Difficult Recipient Bed

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For almost 100 years, skin grafts have been a formidable technique used to cover some of the more difficult wounds encountered in plastic surgery. Critical to the survival of the graft is appropriate contact between the undersurface of the skin graft and the recipient bed. Grafting can usually be accomplished without difficulty over a flat, well-granulated bed that experiences little motion. A tie-over bolster dressing or simple open technique may be all that is necessary to secure a graft in place during the period of inosculation and capillary ingrowth, usually between 2 and 5 days. Over highly irregular surfaces, exudative surfaces, or surfaces subject to repeated motion, grafting becomes much more difficult because revascularization of the graft may be interrupted during the first phase of graft adherence when a thin layer of fibrin is the main adherent.[1] The collection of fluid from exudative or moving beds can result in the failure and complete loss of the graft.

Tie-over bolsters classically have been employed as a method of securing grafts. Such a dressing consists of a bolster of dressing materials, usually cotton, firmly held in place by multiple overlying sutures. This arrangement is frequently cumbersome and fails to evenly distribute pressure to the underlying bed. More recent solutions involve the application of fibrin glue to the graft bed[2] and a variety of splints made from silicones,[3] foams,[4] and self-adherent wraps.[5]

Over the past 5 years, we have applied a Vacuum Assisted Closure (V.A.C.) device (KCI; San Antonio, Texas) to a skin graft as a method of securing the graft in place, particularly over difficult recipient beds. The V.A.C. is a wound-closure device that uses reduced pressure to promote granulation tissue formation in compromised wounds. Using a V.A.C. device to secure a graft prevents fluid collection beneath the graft and ensures positive contact between the bed and the transplanted skin. In addition, the contraction of the V.A.C. sponge secondary to the application of negative pressure ensures that an even amount of pressure is distributed over the entire surface, regardless of the irregularity of the recipient bed. Because the sponge is pliable, movement of the recipient surface is somewhat possible without compromising the graft.

Method

The skin graft is harvested and meshed either 1:1 or 1.5:1. Meshing minimizes the potential for trapping fluid beneath the graft. The graft is then tacked to the recipient site with staples or secured with absorbable sutures. A V.A.C. foam dressing is cut to the appropriate contour of the defect. The foam should be cut slightly larger than the size of graft. The V.A.C. dressing itself is a sterile open-cell foam block with a fenestrated tube running through its center. A thin, porous barrier is then placed between the sponge and graft to prevent the adherence of the sponge to the transplanted epithelium. A monolayer of Adaptic (Johnson and Johnson, Arlington, Texas), Xeroform (Kendall, Mansfield, Mass.), or Vaseline (Sherwood Medical, Markham, Ontario, Canada) gauze is acceptable. An adhesive film supplied with the V.A.C. sponge covers the sponge and

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Two of the authors (Argenta and Morykwas) developed the V.A.C. Wake Forest University has licensed Kinetic Concepts, Inc., to market the device.

the intact skin edges around the graft, allowing a vacuum to be created underneath the entire dressing (Fig. 1, *above*).

The V.A.C. evacuation tubing is brought out in an area where pressure will not be applied. In difficult areas, a patch may be necessary. It is important in complex recipient sites, such as the hand and the perineum, that the monolayer and foam be interposed between each skin graft so that they do not adhere.

The V.A.C. tubing is then connected to a pump that provides 125 mmHg of continuous negative pressure. If there are no leaks in the dressing, the foam will fold in on itself and put an even amount of pressure over the entire graft (Fig. 1, *below*). The foam, because it is soft and deformable, will conform even to the most uneven contour. If the graft has been "pie crusted" or meshed, any fluid that collects on the surface is pulled away and into the closed reservoir of the pump. In this way, no fluid can collect either below or above the graft.

The vacuum is applied to the graft for a period of 3 to 4 days, at which time most grafts are well adhered to the recipient bed. Because the negative pressure attaches the graft so securely onto the bed, patients with lower extremity and perineal wounds can ambulate soon after surgery without fear of disrupting the newly transplanted skin (Figs. 2 and 3).

When the device is used on the hand, we have found that physical therapy can be administered almost immediately, allowing flexion/extension of the digits. We have noted no increase in the failure of the graft with or without physical therapy.

Results

Over the past 5 years, we have used this method of securing skin grafts in a wide variety

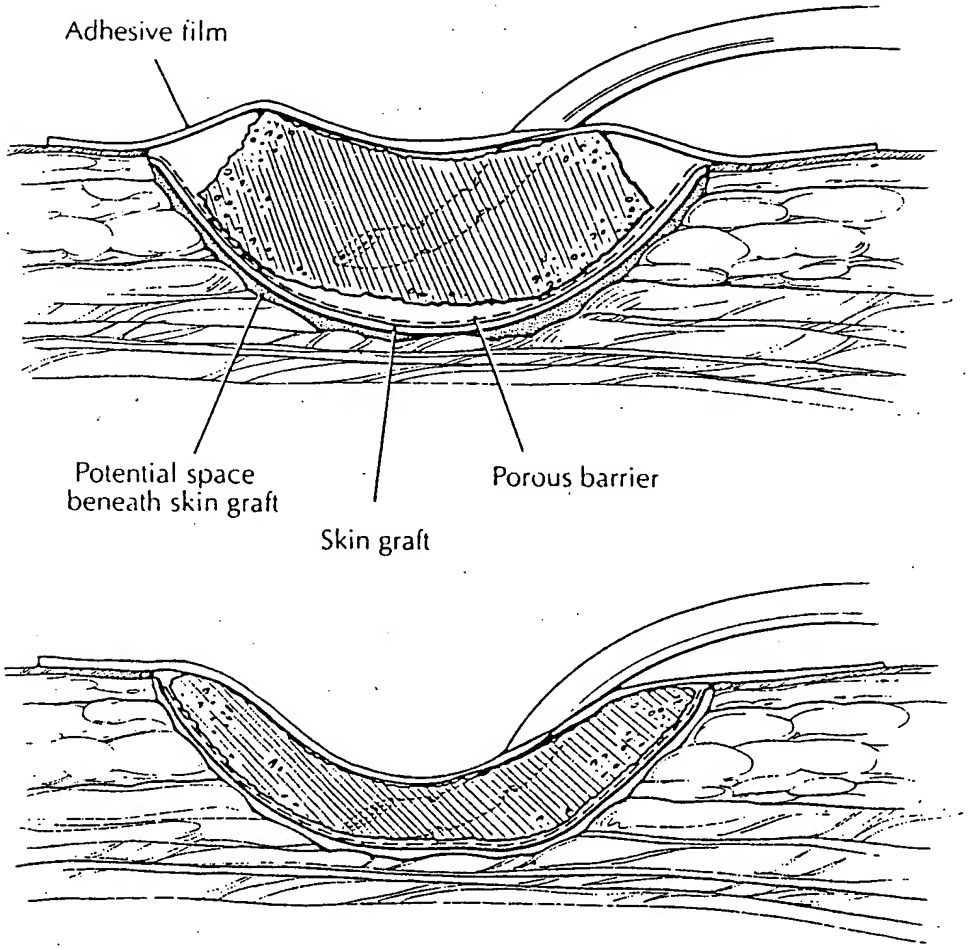

Fig. 1. (*Above*) Diagram showing a V.A.C. foam dressing on a wound. (*Below*) Diagram demonstrating the infolding of the foam upon itself that serves to distribute the pressure evenly on the graft.

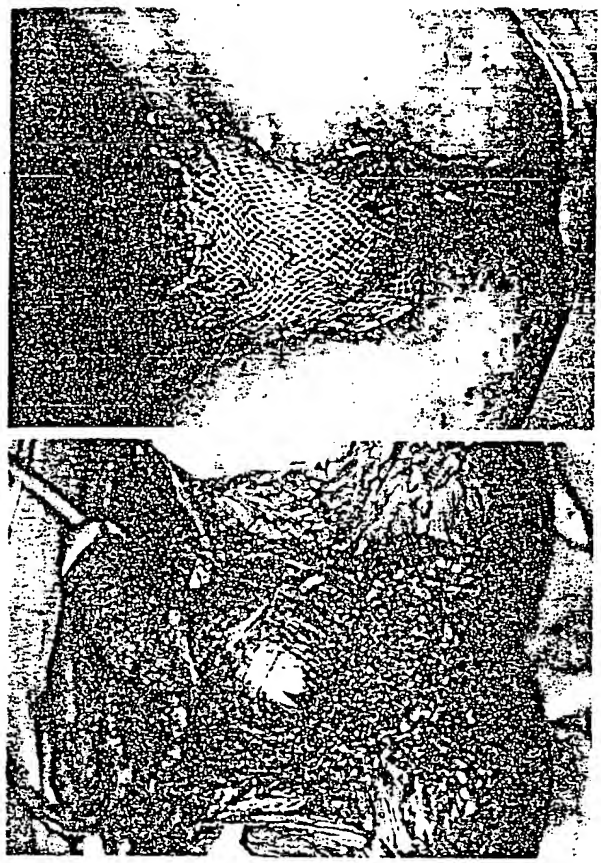

FIG. 2. (*Above*) Meshed graft applied to the perineum, typically a difficult area to skin graft. (*Below*) V.A.C. dressing in place, holding the skin graft securely to the recipient bed. A 100-percent take was achieved.

of patients. More than 100 chronic wounds, acute wounds, and burns have been treated, and patients from 2 months to 97 years of age have been treated with this method. Grafts have been applied to all areas of the body, including the feet, lower extremities, perineum, genitalia, trunk, hands, face, and scalp. No patient has lost a graft because of fluid collecting beneath the skin graft. All but two patients demonstrated a complete take of the graft, and these two patients had grossly contaminated chronic wounds. Patients have found the dressing to be comfortable and to allow for early, limited movement.

When removing the foam and barrier, one must be careful not to disturb the graft, because shearing can occur during graft manipulation. In a few instances, buds of granulation tissue may protrude through the mesh interstices. This will resolve quickly when the negative pressure is discontinued. The application of silver nitrate may also be useful when granulation tissue protrudes through the graft.

FIG. 3. (*Above*) This infant had a full-thickness skin loss on both lower extremities. (*Center*) Large V.A.C. sponges were applied to both legs to hold the skin grafts in place. The child was allowed to crawl and move immediately after surgery. (*Below*) There was a 100-percent take after 4 days of treatment despite ongoing movement.

Although no controlled studies have been performed, we have found this new technique of dressing grafts to be excellent for circumstances in which a skin graft must be placed over an irregular surface, such as a heel, ankle, hand, axilla, or perineum. It is also an ideal dressing for grafts that predictably will be exposed to shear forces. As opposed to the standard bolus tie-over type of dressing, this system evenly distributes pressure and secures trans-

planted skin firmly against the recipient site. High pressure is not required for a graft to take, but continuous contact certainly is. We believe that the advantage of the V.A.C. dressing is that continuous, firm contact between the graft and the bed is reliably maintained.

Because any fluid that accumulates is immediately evacuated, the wound remains clean, thus limiting the chance of infection. We have, however, also used this type of dressing on unmeshed grafts, mostly on the head and neck, and found that when the dressing was removed, there was a good take and no fluid accumulation beneath the bed and transplanted skin.

In summary, many skin grafts can be held in place with the traditional methods that have been used for almost a century. When the recipient bed is difficult and securing the graft seems to be the most challenging aspect of the procedure, we have found that our described method of holding skin grafts in place is simple, quick, and has almost no morbidity. If there is concern about the graft, the dressing can be removed at any time. As plastic surgeons, we are continually confronted with difficult wounds that require skin coverage. This method of securing skin grafts should be useful to the surgeon faced with a less-than-ideal recipient bed where prolonged, positive contact is essential for a satisfactory result.

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